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Otani et al.

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(54) **IMAGING APPARATUS, MANUFACTURING APPARATUS, MANUFACTURING METHOD AND ELECTRONIC APPLIANCE**

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(30) **Foreign Application Priority Data**

Aug. 8, 2013 (JP) 2013-172536

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G02B 7/08 (2021.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04N 5/2253*** (2013.01); ***G02B 7/08*** (2013.01); ***H04N 5/2252*** (2013.01);
(Continued)

(58) **Field of Classification Search**
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(56) **References Cited**

U.S. PATENT DOCUMENTS

10,044,917 B2 * 8/2018 Otani G02B 7/08
10,764,479 B2 * 9/2020 Otani H04N 5/2252
(Continued)

FOREIGN PATENT DOCUMENTS

CN 1494139 A 5/2004
CN 1842137 A 10/2006
(Continued)

OTHER PUBLICATIONS

Office Action for CN Patent Application No. 201480045323.0, dated Jul. 3, 2018, 08 pages of Office Action and 32 pages of English Translation.

(Continued)

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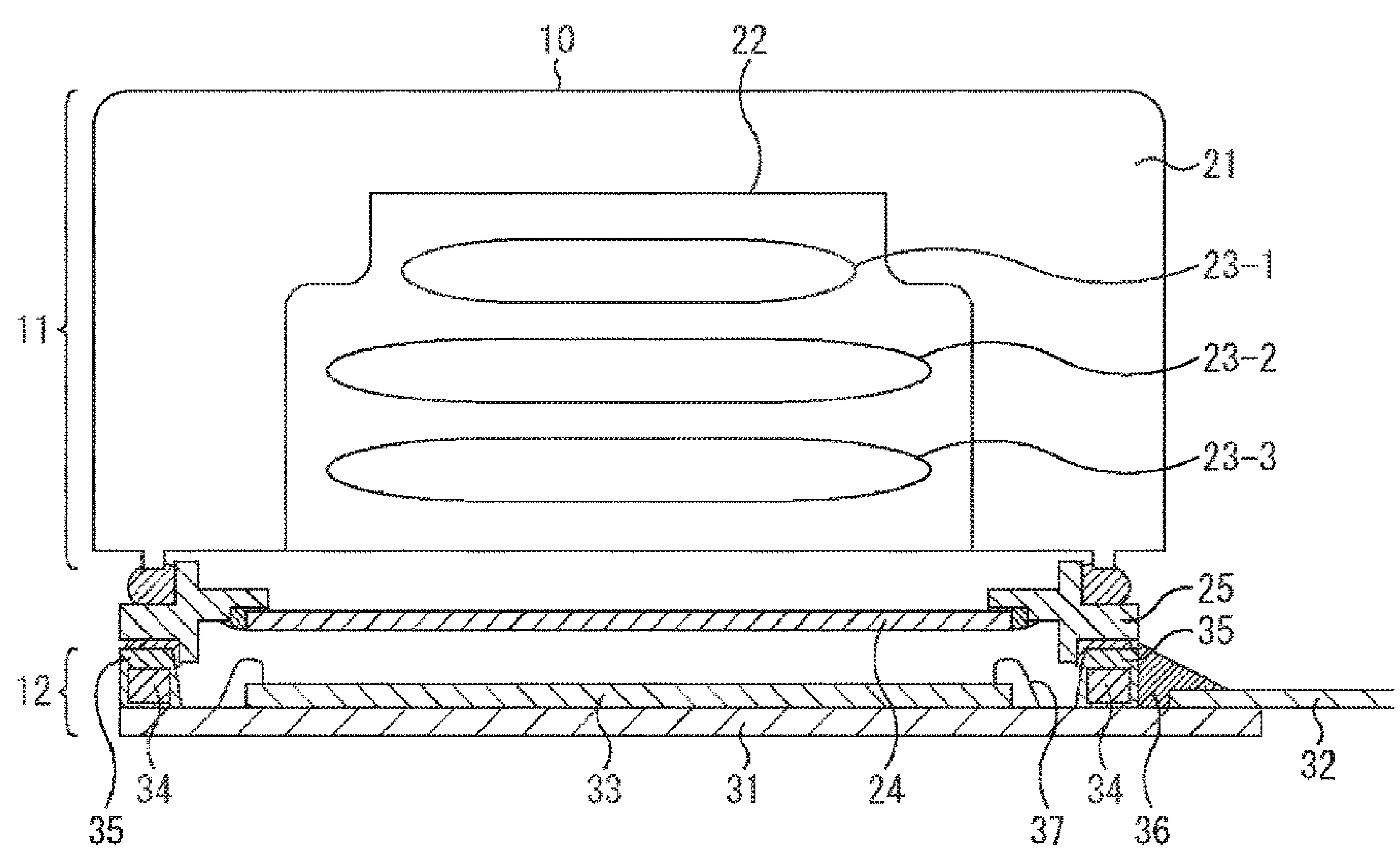
(57) **ABSTRACT**

The present technology relates to an imaging apparatus, a manufacturing apparatus, a manufacturing method, and an electronic appliance that contribute to miniaturization and thinning of an imaging apparatus. Provided is an imaging apparatus including a first circuit board in which an imaging element is mounted on a center portion, a component that is mounted on an outer circumference portion of the center portion of the first circuit board, and a member that incorporates the component and is provided in the outer circumference portion and is formed by a mold method. The imaging apparatus further includes a lens barrel that holds a lens, in which a frame that supports a portion including the lens barrel is located on the member. Further, the frame includes an infra red cut filter (IRCF). The present technology can be applied to an imaging apparatus.

10 Claims, 6 Drawing Sheets



Related U.S. Application Data

continuation of application No. 14/903,110, filed as application No. PCT/JP2014/071035 on Aug. 8, 2014, now Pat. No. 10,044,917.

(51) **Int. Cl.**

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G02B 13/00	(2006.01)
G03B 11/00	(2021.01)
G03B 17/02	(2021.01)

(52) **U.S. Cl.**
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(56) **References Cited**

U.S. PATENT DOCUMENTS

2004/0080642	A1*	4/2004	Kobayashi	H04N 5/2254 348/294
2004/0251509	A1	12/2004	Choi	
2005/0012032	A1*	1/2005	Onodera	H01L 27/146 250/214.1
2006/0103953	A1	5/2006	Lee et al.	
2006/0219884	A1	10/2006	Tsukamoto et al.	
2006/0219885	A1	10/2006	Kinoshita et al.	
2010/0103296	A1	4/2010	Nakagiri et al.	
2011/0084118	A1	4/2011	Wada et al.	
2011/0194023	A1*	8/2011	Tam	H04N 5/2253 348/374
2012/0105713	A1	5/2012	Luan	

FOREIGN PATENT DOCUMENTS

CN	1842139	A	10/2006
CN	101569178	A	10/2009
CN	102782574	A	11/2012
DE	102005021176	A1	5/2006
EP	1708279	A2	10/2006
EP	1708476	A2	10/2006
EP	2136552	A1	12/2009
JP	09-130683	A	5/1997
JP	2006-166398	A	6/2006
JP	2006-276463	A	10/2006
JP	2006-287533	A	10/2006
JP	2007-523568	A	8/2007
JP	2008-312104	A	12/2008
JP	2010-041213	A	2/2010
JP	2011-086610	A	4/2011
JP	2011-086670	A	4/2011
JP	2013-070270	A	4/2013
KR	10-2006-0104949	A	10/2006
KR	10-2006-0105677	A	10/2006
KR	10-2009-0037570	A	4/2009
KR	10-2009-0128374	A	12/2009
KR	10-2010-0020614	A	2/2010
KR	10-2011-0002266	A	1/2011
TW	I302209	B	10/2008
TW	I305959	B	2/2009
WO	2008/132802	A1	11/2008

OTHER PUBLICATIONS

Notice of Allowance for U.S. Appl. No. 14/903,110, dated May 17, 2018, 06 pages.
Notice of Allowance for U.S. Appl. No. 14/903,110, dated Apr. 10, 2018, 11 pages.
Non-Final Office Action for U.S. Appl. No. 14/903,110, dated Nov. 24, 2017, 25 pages.
Advisory Action for U.S. Appl. No. 14/903,110, dated Aug. 25, 2017, 03 pages.
Final Office Action for U.S. Appl. No. 14/903,110, dated Jun. 9, 2017, 24 pages.
Non-Final Office Action for U.S. Appl. No. 14/903,110, dated Dec. 2, 2016, 13 pages.
International Search Report and Written Opinion of PCT Application No. PCT/JP2014/071035, dated Nov. 4, 2014, 09 pages of English Translation and 08 pages of ISRWO.
International Preliminary Report on Patentability of PCT Application No. PCT/JP2014/071035, dated Mar. 3, 2016, 09 pages of English Translation and 06 pages of IPRP.
Office Action for JP Patent Application No. 2015-532812, dated Apr. 24, 2018, 07 pages of Office Action and 04 pages of English Translation.
Notice of Allowance for U.S. Appl. No. 16/054,441, dated Apr. 24, 2020, 10 pages.
Non-Final Office Action U.S. Appl. No. 16/054,441, dated Oct. 7, 2019, 12 pages.
Notice of Allowance for KR Patent Application No. 10-2016-7000357, dated Nov. 25, 2021, 06 pages of Notice of Allowance and 2 pages of Translation.

* cited by examiner

FIG. 1

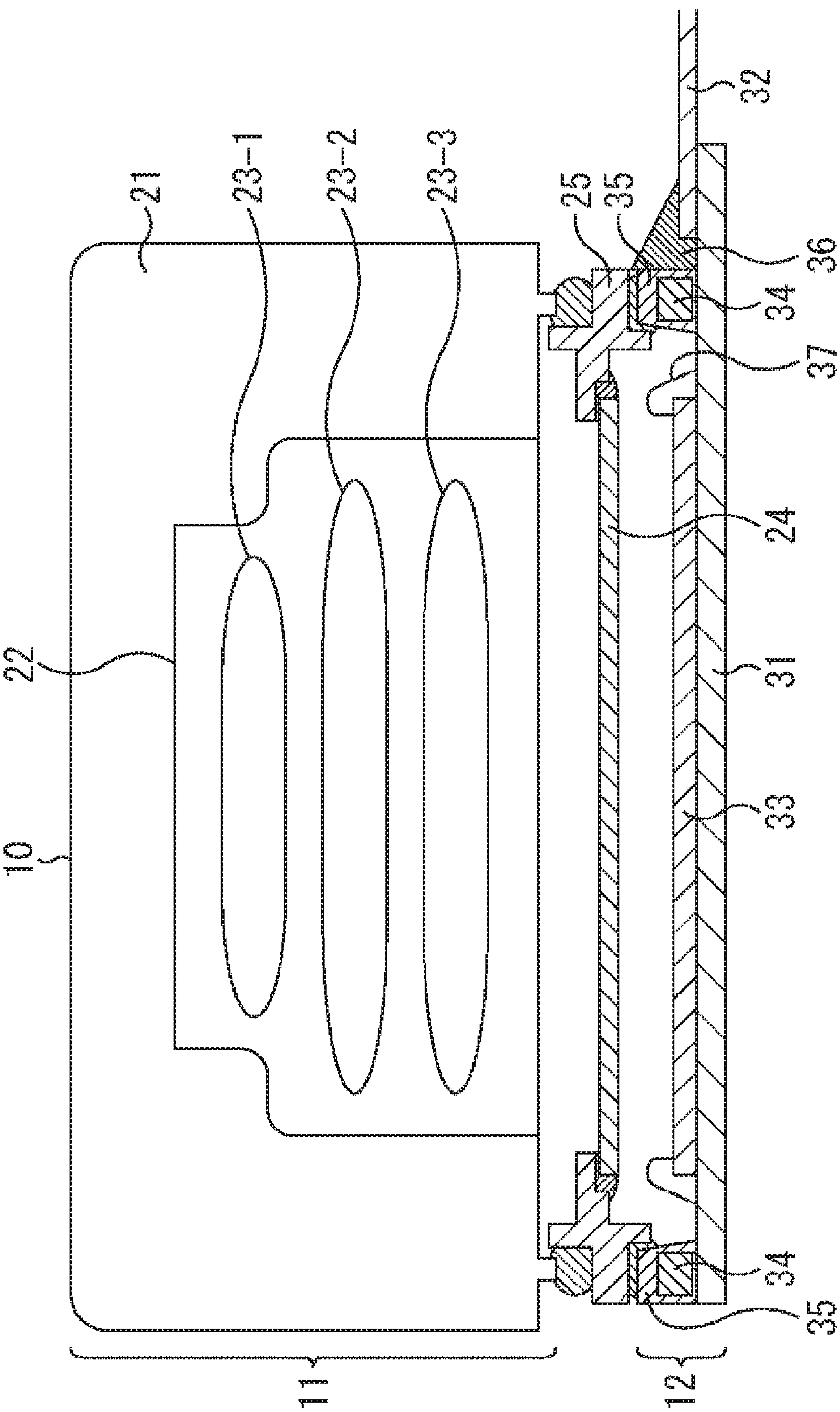


FIG. 2

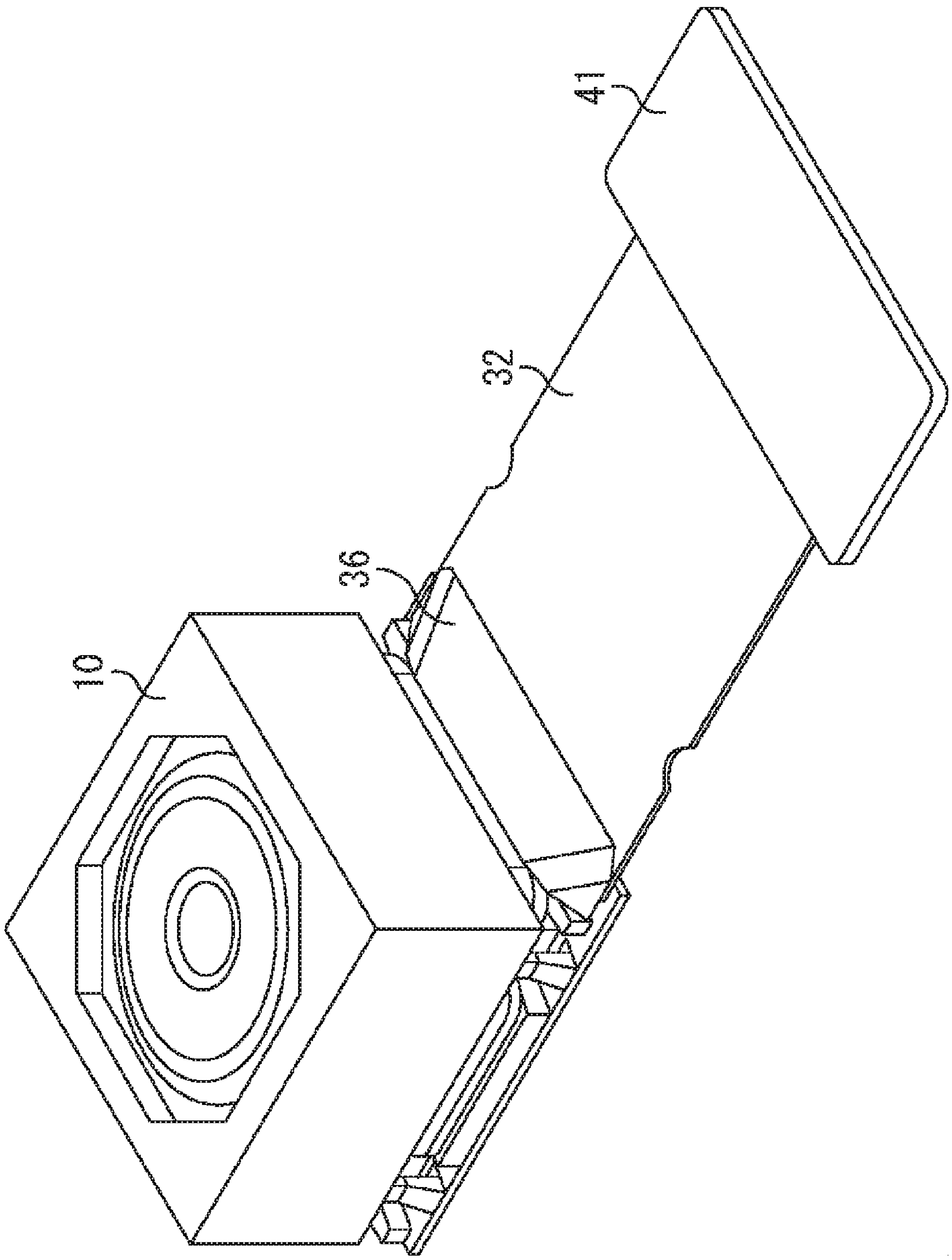


FIG. 3

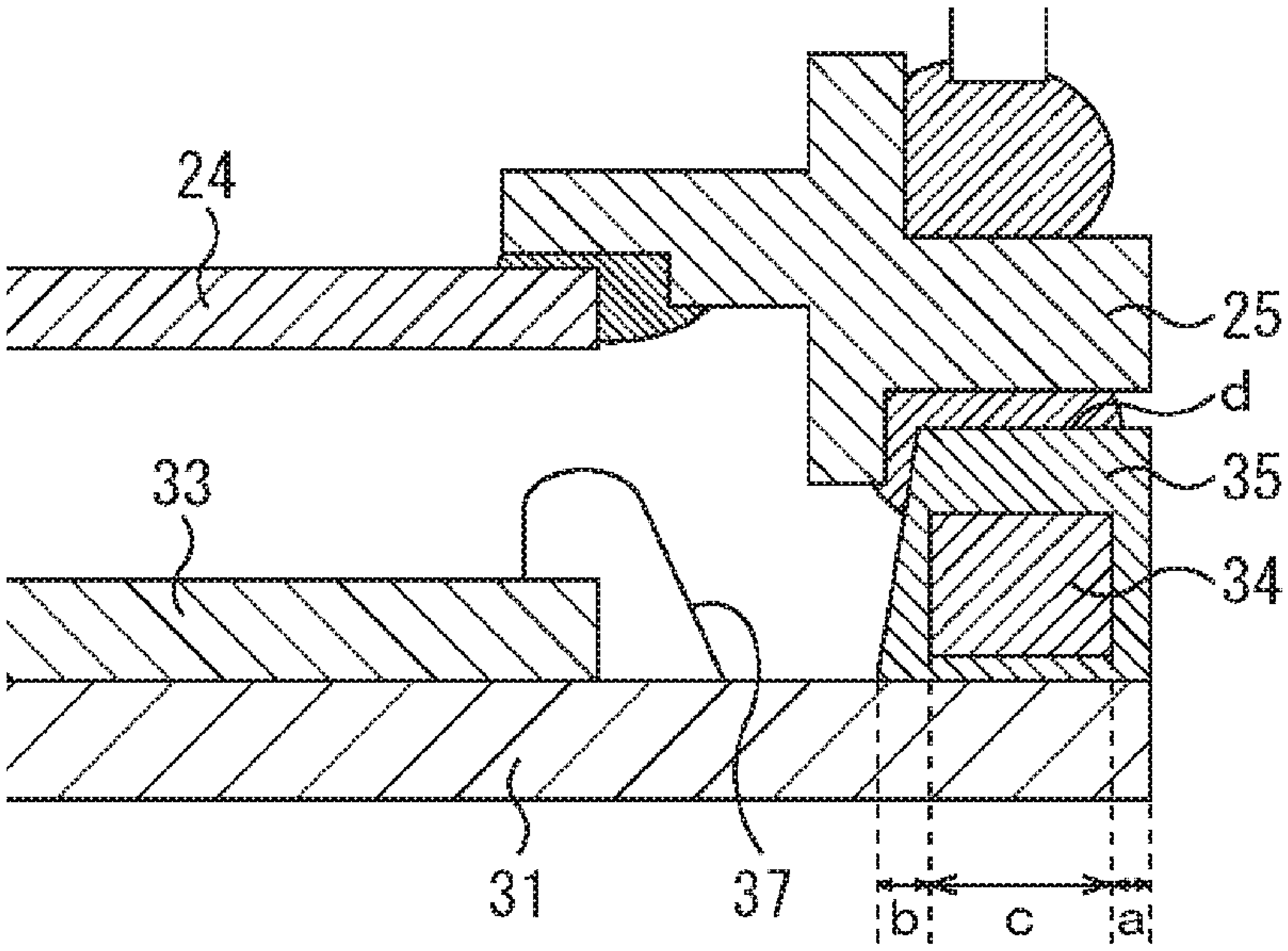


FIG. 4

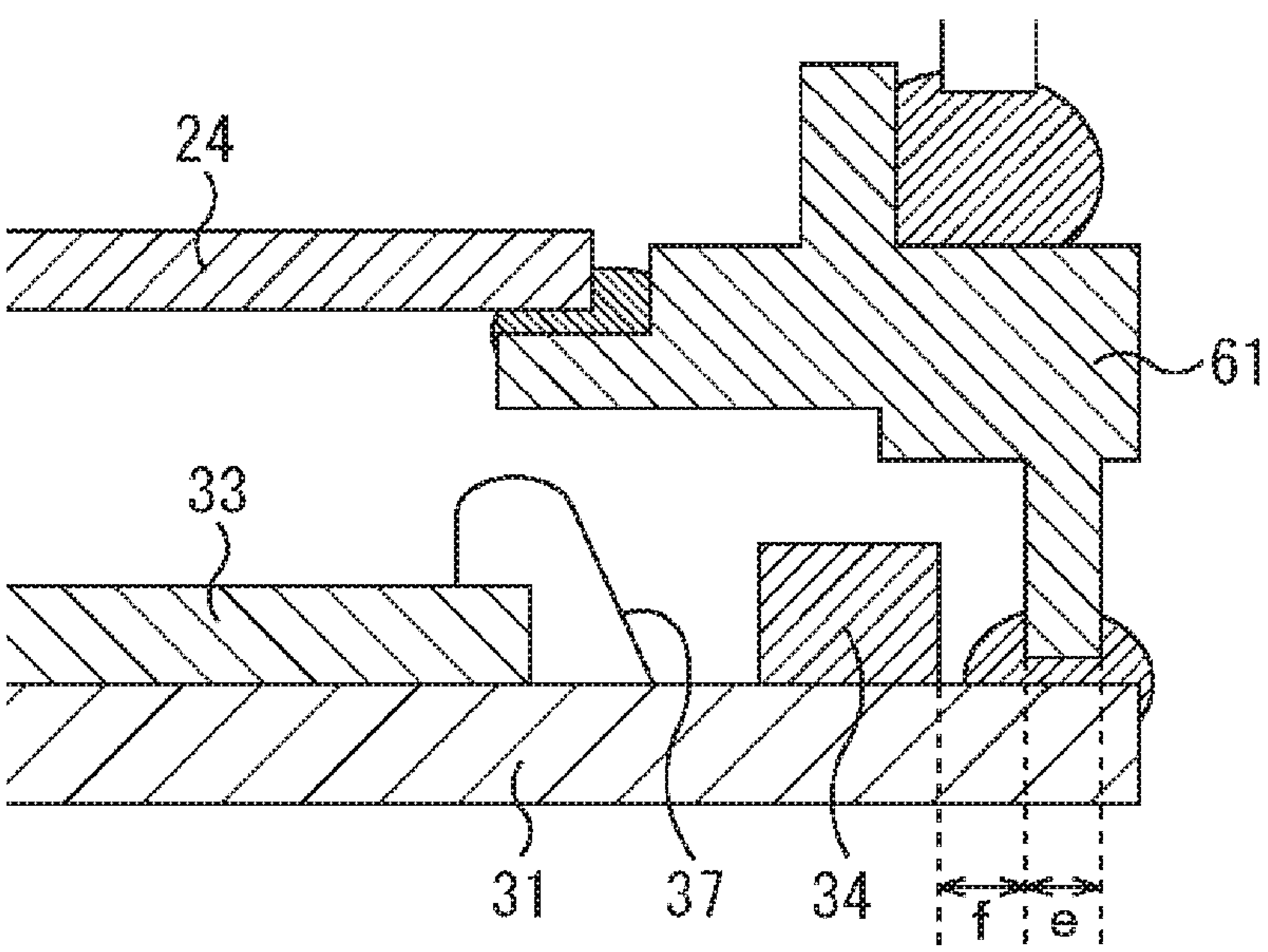


FIG. 5

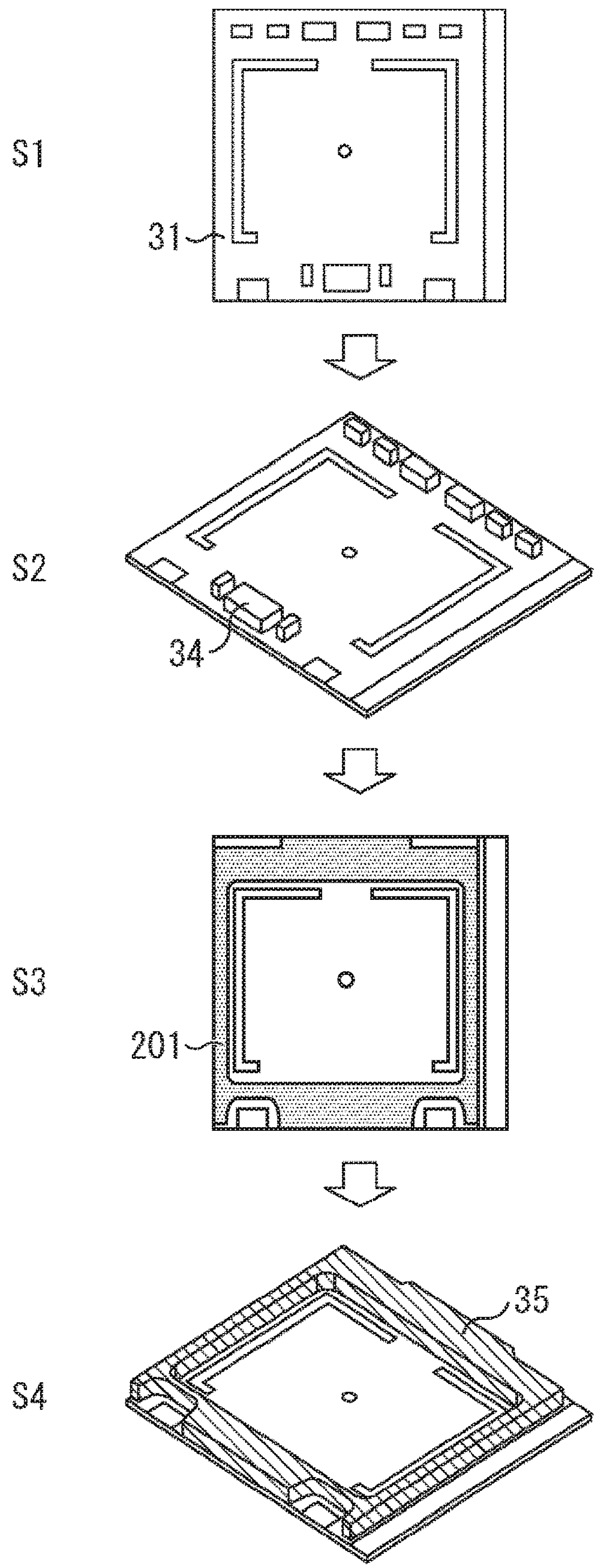


FIG. 6

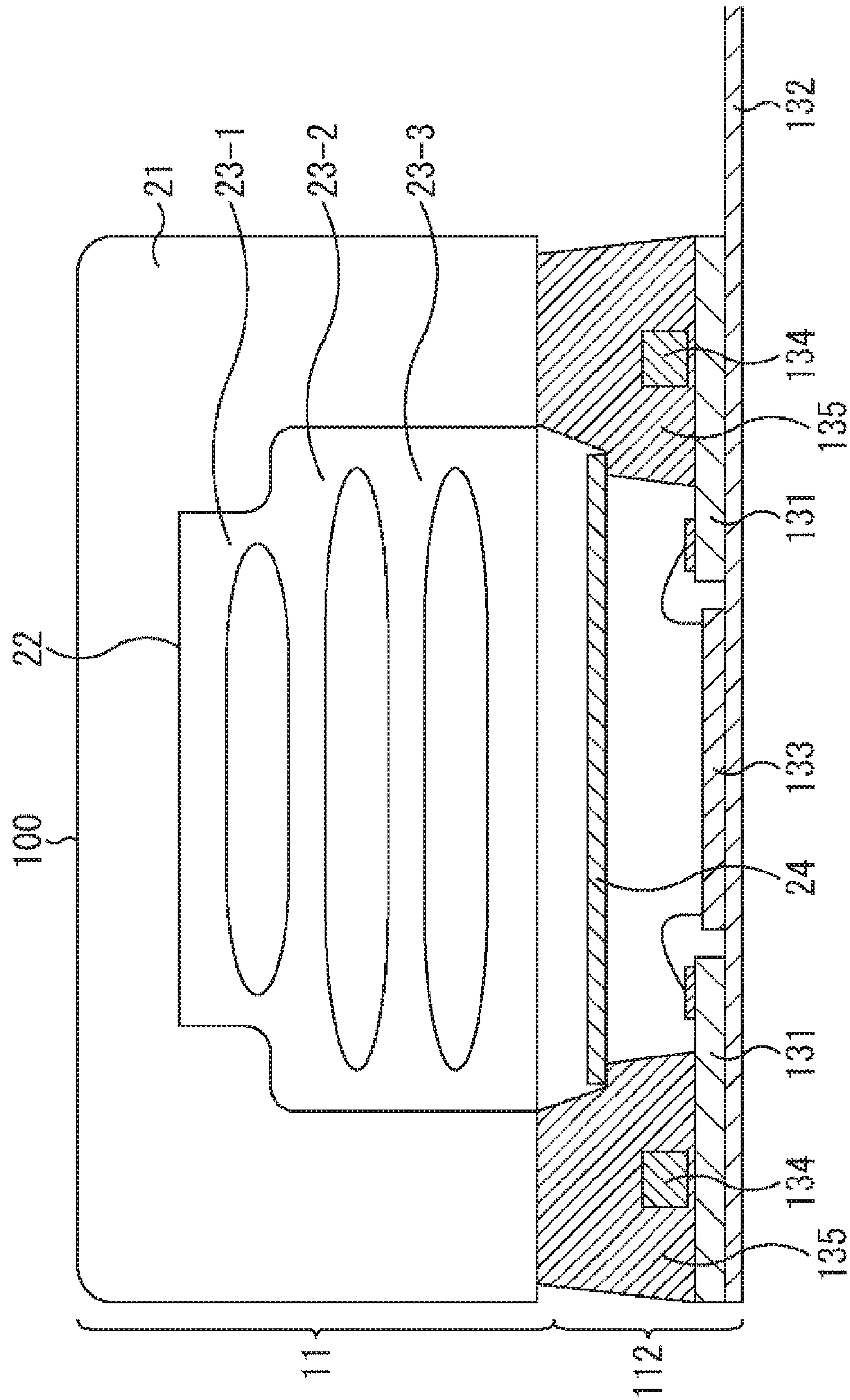
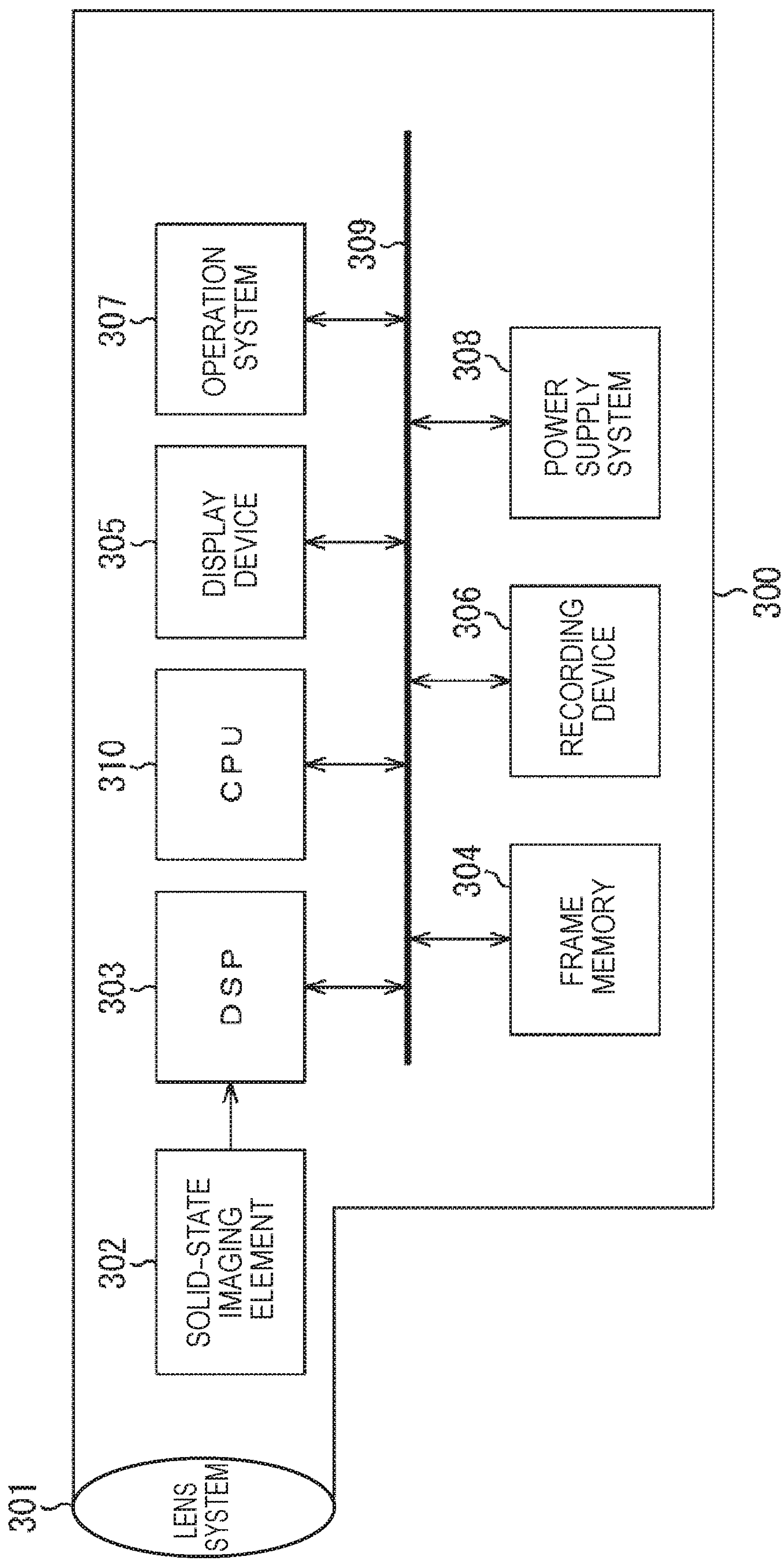


FIG. 7


300
301
LENS SYSTEM
302
SOLID-STATE IMAGING ELEMENT
303
DSP
310
CPU
305
DISPLAY DEVICE
307
OPERATION SYSTEM
309
304
FRAME MEMORY
306
RECORDING DEVICE
308
POWER SUPPLY SYSTEM

IMAGING APPARATUS, MANUFACTURING APPARATUS, MANUFACTURING METHOD AND ELECTRONIC APPLIANCE

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is a continuation application of U.S. patent application Ser. No. 16/054,441, filed Aug. 3, 2018, which is a continuation of U.S. patent application Ser. No. 14/903,110, filed on Jan. 6, 2016, now U.S. Pat. No. 10,044,917, which is a National Stage Entry of PCT/JP2014/071035, filed Aug. 8, 2014, and claims the benefit of priority from Japanese Priority Patent Application JP 2013-172536 filed in the Japan Patent Office on Aug. 8, 2013, the entire contents of which are hereby incorporated by reference.

TECHNICAL FIELD

The present technology relates to an imaging apparatus, a manufacturing apparatus, a manufacturing method, and an electronic appliance. Particularly, it relates to an imaging apparatus, a manufacturing apparatus, a manufacturing method, and an electronic appliance that contribute to miniaturization of a module.

BACKGROUND ART

In recent years, it has been desirable to miniaturize a digital camera, and with the spread of a cellular phone having a function of a digital camera, to miniaturize an autofocus driving apparatus and the like. It has been proposed to realize miniaturization by sealing a lens holder, a chip and a circuit board (see Patent Literature 1).

CITATION LIST

Patent Literature

Patent Literature 1: JP 2007-523568T

SUMMARY OF INVENTION

Technical Problem

Although miniaturization of an optical system such as a lens makes it possible to realize miniaturization of an imaging apparatus, undesirable states such as a reduction in optical amount and deterioration in image quality are highly likely to be generated. Therefore, it is not preferable to miniaturize the imaging apparatus by miniaturizing a lens and the like. However, as described above, it has been desirable to further miniaturize the imaging apparatus.

The present technology has been developed in light of such a situation, and it is capable of realizing further miniaturization of the imaging apparatus.

Solution to Problem

An imaging apparatus according to an embodiment of the present technology includes: a first circuit hoard in which an imaging element is mounted on a center portion; a component that is mounted on an outer circumference portion of the center portion of the first circuit hoard; and a member that incorporates the component and is provided in the outer circumference portion.

The member can be formed by a mold method.

The imaging apparatus can further include: a lens barrel that holds a lens. A frame that supports a portion including the lens barrel can be located on the member.

The frame can include an infra red cut filter (IRCF).

One side of the first circuit board can connected to a second circuit hoard. A reinforcement member for reinforcing connection between the first circuit hoard and the second circuit board can provided in a predetermined portion of the second circuit board and the member. The imaging apparatus can further include: a lens barrel that holds a lens, A portion including the lens barrel can be located on the member.

The member can be formed in a shape having a step. An infra red cut filter (IRCF) can be mounted on a portion of the step.

A portion of the first circuit board on which the imaging element is to be mounted can be formed into a cavity. A second circuit hoard can be attached to a lower portion of the first circuit board, and the imaging element can be mounted on the second circuit board.

The member can be formed by covering, with a predetermined mold, the first circuit board to which the component is attached, and injecting a resin to the mold.

A manufacturing apparatus according to an embodiment of the present technology manufactures an imaging apparatus including a first circuit board in which an imaging element is mounted on a center portion, a component that is mounted on an outer circumference portion of the center portion of the first circuit hoard, and a member that incorporates the component and is provided in the outer circumference portion.

The member can be formed by covering, with a predetermined mold, the first circuit board to which the component is attached, and injecting a resin to the mold.

A manufacturing method according to an embodiment of the present technology for a manufacturing apparatus that manufactures an imaging apparatus, the imaging apparatus including a first circuit board in which an imaging element is mounted on a center portion, a component that is mounted on an outer circumference portion of the center portion of the first circuit board, and a member that incorporates the component and is provided in the outer circumference portion, includes: a step of forming the member by covering, with a predetermined mold, the first circuit hoard on which the component is mounted, and injecting a resin to the mold.

An electronic appliance according to an embodiment of the present technology includes: an imaging apparatus including a first circuit board in which an imaging element is mounted on a center portion, a component that is mounted on an outer circumference portion of the center portion of the first circuit board, and a member that incorporates the component and is provided in the outer circumference portion; and a signal processing unit that performs signal processing for a pixel signal outputted from the imaging element.

An imaging apparatus according to an embodiment of the present technology at least includes a first circuit board on which an imaging element is mounted in a center portion, a component mounted in an outer circumference portion of the center portion of the first circuit board, and a member incorporating the component and provided in the outer circumference portion.

In a manufacturing apparatus and a manufacturing method according to an embodiment of the present technology, the imaging apparatus is manufactured.

In an electronic compliance according to an embodiment of the present technology, the imaging apparatus is included.

Advantageous Effects of Invention

According to an embodiment of the present technology, it is possible to miniaturize the imaging apparatus.

Note that the effect described here is not limited, and may be any effect described in the present disclosure.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a cross-sectional diagram illustrating a configuration of an imaging apparatus.

FIG. **2** is a diagram illustrating the imaging apparatus.

FIG. **3** is a cross-sectional diagram illustrating a configuration of a lower part of the imaging apparatus.

FIG. **4** is a cross-sectional diagram illustrating another configuration of the lower part of the imaging apparatus.

FIG. **5** is a diagram for explaining manufacturing of the imaging apparatus.

FIG. **6** is a cross-sectional diagram illustrating another configuration of the imaging apparatus.

FIG. **7** is a diagram illustrating a configuration of an electronic appliance.

DESCRIPTION OF EMBODIMENTS

An aspect for implementing the present technology (hereinafter referred to as an embodiment) will be described below. Note that the description will be provided in the following order.

1. Configuration of Imaging Apparatus
2. Configuration of Lower Part of Imaging Apparatus
3. Manufacturing of Imaging Apparatus
4. Another Configuration of Lower Part of Imaging Apparatus
5. Electronic Appliance

<Configuration of Imaging Apparatus>

FIG. **1**. is a cross-sectional diagram illustrating a configuration of an imaging apparatus. Further, FIG. **2** is a diagram illustrating an exterior configuration of the imaging apparatus. An imaging apparatus **10** of FIG. **1** includes an upper part **11** and a lower part **12**. Here, for convenience of explanation, description is provided assuming that the imaging apparatus **10** includes the upper part **11** and the lower part **12**.

The upper part **11** includes an actuator **21**, a lens barrel **22**, a lens **23**, an infra red cut filter (IRCF) **24**, and a frame **25**. The lower part **12** includes a first circuit board **31**, a second circuit board **32**, an imaging element **33**, a component **34** and a mold part **35**.

A lens **23-1**, a lens **23-2** and a lens **23-3** are incorporated in the inside of the lens barrel **22**, and the lens barrel **22** holds those lenses **23-1** to **23-3**. The lens barrel **22** is contained in the actuator **21**, and the lower part **12** is attached to the lower part of the actuator **21**.

For example, a screw (not shown) is included on a side face in the outside of the lens barrel **22**, and a screw (not shown) is included at such a position as to be screwed to this screw in one part in the inside of the actuator **21**, and the screw of the lens barrel **22** and the screw in the inside of the actuator **21** are screwed to each other. The lens barrel **22** is screwed to the actuator **21** in order to adjust a distance from the imaging element **33** (for focusing) during manufacturing. Note that such a method for attaching the lens barrel **22** to the actuator **21** is an example, and the lens barrel **22** may be attached to the actuator **21** by another mechanism.

When the lens barrel **22** is configured to be movable in the vertical direction in the drawing so that an auto-focus (AF) can be performed, for example, a coil is provided on a side face of the lens barrel **22** (a lens carry having the lens barrel **22** attached thereto). Further, a magnet is provided at such a position as to face the coil in the inside of the actuator **21**. A yoke is included in the magnet, and a voice coil motor includes the coil, the magnet and the yoke.

When a current flows in the coil, force is generated in the vertical direction in the drawing. This generated force moves the lens barrel **22** in the upper direction or the lower direction. When the lens barrel **22** is moved, a distance between the imaging element **33** and the lenses **23-1** to **23-3** held by the lens barrel **22** is changed. Such a mechanism can realize the auto-focus.

Note that another mechanism may realize the auto-focus, and a configuration is applied according to a method for realizing that.

The imaging element **33** is provided in the center portion of the lower part **12**. The imaging element **33** is attached onto the first circuit board **31** and connected to the first circuit board **31** by wiring **37**. The plurality of components **34** for processing a signal from the imaging element **33** are arranged in a portion around the imaging element **33** in the outer circumference part of the first circuit board **31** on the top of the first circuit board **31**, and are attached onto the first circuit hoard **31**. This component **34** is arranged in such a manner that one side is in contact with the first circuit hoard **31** and the other three sides are surrounded by the mold part **35**.

As described later, the mold part **35** is manufactured by, for example, a mold method. Note that, although it is described as the mold part here, it is not limited to the mold, and as described later it may be a member incorporating the components **34**, functioning as a protection part for protecting the components **34**, and having a function as a holding part supporting the upper part **11**.

The frame **25** is attached to a face on a side opposite to the first circuit board **31** in the upper part of the mold part **35**. This frame **25** has a function holding the IRCF **24**. Further, the lens barrel **22** and others are provided on a side opposite to a side in contact with the mold part **35**, of the frame **25**.

In one side of the first circuit hoard **31**, a portion to which the second circuit board **32** is connected is provided. The second circuit board **32** is, for example, a flexible print board (FPC), and is used as a circuit board for supplying a signal from the first circuit board **31** to a connector **41** as shown in FIG. **2**.

The second circuit board **32** is attached so as to be put on the one side of the first circuit board **31**, but as shown in FIG. **1** and FIG. **2**, a reinforcement member **36** is provided in a part on the second circuit board **32** in order to reinforce the attached portion.

<Configuration of Lower Part of Imaging Apparatus>

The imaging apparatus **10** to which the present technology is applied is configured to allow the thickness of the first circuit board **31** to be reduced and allow the components **34** to be protected from a shock or the like, by causing the mold part **35** to support the frame **25**. This will be described with reference to FIG. **3**.

FIG. **3** is an enlarged diagram illustrating a right side part of the lower part **12** of the imaging apparatus **10**. As shown in FIG. **3**, let a length from the right end of the component **34** to the right end of the mold part **35** be a width a, and let a length from the left end of the component **34** to the left end of the mold part **35** be a width b. Further, let a width of the component **34** be a width c.

As described later, the mold part **35** can be formed by injecting a resin. Injecting a resin to form the mold part **35** makes it possible to form the mold part **35** while the components **34** are contained in the mold part **35** and the mold part **35** is in contact with the components **34**. Therefore, it can be thought that the components **34** are incorporated in the mold part **35** in a pseudo manner, and constitute a part of the mold part **35**. Constituting a part of the mold part **35** means a state in which a load of the upper part **11** is applied to the mold part **35**, but the load is applied not only to the mold part **35** but to the components **34**.

The load is dispersed when supporting the upper part **11** by the components **34** and the mold part **35** more than when supporting the upper part **11** only by the mold part **35**, making it possible to prevent warpage and the like from being generated in the first circuit board **31**. This will be described in comparison with when the frame **25** is assumed to be in contact with the first circuit board **31** to support the upper part Li without providing the mold part **35**.

FIG. **4** is a diagram illustrating a structure when the frame **25** is in contact with the first circuit board **31** to support the upper part **11** without providing the mold part **35**. Further, similarly to FIG. **3**, FIG. **4** is an enlarged diagram illustrating a right side part of the lower part **12**. Since the lower part **12** shown in FIG. **4** has a frame **61** having a shape different from that of the frame **25** of FIG. **3**, and the other structural elements are similar to those of the lower part **12** of FIG. **4**, they are denoted with the same signs and description will be continued.

In the lower part **12** shown in FIG. **4**, the frame **61** is in direct contact with the first circuit board **31**. A portion of the frame **61** in contact with the first circuit board **31** is optionally described as a leg. As shown in FIG. **4**, a length of the portion of the frame **61** in contact with the first circuit hoard **31** is a width e, and a width of a space between the left side of the leg portion of the frame **61** and the right side of the component **24** is a width f.

When the upper part **11** and the lower part **12** are integrated in such a manner that the components **34** are attached to the first circuit board **31** and then the frame **61** is put on the first circuit board **31**, it is necessary to provide a gap between the component **34** and the leg of the frame **61** so as to prevent the leg of the frame **61** from coming into contact with the component **34** when the frame **61** is put on the first circuit board **31**. This gap is to be the width f.

When the frame **61** is directly put on the first circuit board **31**, and the upper part **11** is put on the first circuit board **31**, the leg portion of the frame **61** having the width e will support the upper part **11**. When the leg portion (width e) is thinned, the load is concentrated on the thinned led portion. The leg portions of the frame **61** are provided at such positons as to surround the imaging element **33** in the outer circumference portion of the first circuit board **31**.

That is, in this case, the load will be locally applied to the outer circumference portion of the first circuit board **31**. When such a local load is applied, warpage may be generated in the first circuit hoard **31**. In order to prevent the generation of such warpage, it is necessary to increase the thickness of the first circuit board **31**, or increase the width e of the leg portion of the frame **61**.

Accordingly, when the frame **61** is provided so as to be in direct contact with the first circuit board **31**, it becomes necessary to provide a certain level of the width e and the gap width f.

In contrast, when the mold part **35** is provided, referring to FIG. **3** again, the first circuit board **31** is in contact with the mold part **35** at the width of the width a+the width b. Further, in consideration of the components **34** incorporated in the mold part **35** in a pseudo manner, the mold part **35** is in contact with the first circuit board **31** at the width a+the width b+the width c. Therefore, the mold part **35** having the width of the width a+the width b+the width c will support the upper part **11**.

It is evident that the width a+the width b+the width c can be greater than the width e shown in FIG. **4**. Further, when the width e is assumed to be set to the same width as the width a+the width b+the width c, the width of the leg portion of the frame **61** is increased, and thus it is necessary to increase a size of the first circuit board **31** on which the frame **61** is put, thereby preventing the miniaturization of the imaging apparatus **10**.

On the other hand, when the width a+the width b+the width c is assumed to be set to be the same width as the width e, the thickness of the width a or the width b may be reduced. Therefore, as shown in FIG. **3**, when the mold part **35** is provided, it is possible to obtain a configuration contributing to the miniaturization of the imaging apparatus **10**.

Furthermore, it is easy to set the width a+the width b+the width c to be greater than the width e. For example, when the width e is assumed to be the same as the width c, the width a+the width b+the width c is greater than the width e by the width a+the width b. In this manner, when the width a+the width b+the width c can be increased, the load applied to the first circuit board **31** by the upper part **11** can be dispersed.

The dispersion of the load allows the reason for the warpage of the first circuit board **31** to be eliminated. Therefore, when the mold part **35** is provided, it is possible to reduce the thickness of the first circuit board **31**. Also from this point of view, it is possible to miniaturize (thin) the imaging apparatus **10**.

Furthermore, as described with reference to FIG. **4**, when the frame **61** is in direct contact with the first circuit hoard **31**, it is necessary to provide the gap having the width f in consideration of the assembly of the imaging apparatus **10**. In the mold part **35** shown in FIG. **3**, however, it is not necessary to provide such a gap. Therefore, it is evident to miniaturize the first circuit board **31** by the width f.

When the mold part **35** is provided in this manner, it is possible to support the upper part **11** by the width a+the width b+the width c, making it possible to miniaturize or thin the imaging apparatus **10**. Further, when the upper part **11** can be supported by the width a+the width b+the width c, it becomes possible to improve the rigidity.

For example, even when force is applied to the imaging apparatus **10** from above, since the upper part **11** is supported by the width a+the width b+the width c, the applied force can be dispersed to prevent damage to the first circuit board **31** and others. Further, the components **34** are incorporated in the mold part **35** to allow the components **34** to be protected by the mold part **35**, making it possible to prevent the components **34** from being damaged by the applied force.

<Manufacturing of Imaging Apparatus>

Next, manufacturing of the imaging apparatus **10** having the mold part **35** described with reference to FIG. **1** to FIG. **3** will be descried in addition.

At Step S1, the first circuit board **31** is set. As shown at Step S1, in the first circuit board **31**, a region on which the imaging element **33** is to be mounted is provided in the center portion, and a region on which the components are to be mounted is provided in the outer circumference portion of the center portion. Further, a region to be connected to the second circuit board **32** is provided on the right side in the drawing.

At Step S**2**, the components **34** are mounted on the first circuit board **31**. As shown in FIG. **5**, the plurality of components **34** are mounted on a predetermined portion of the first circuit board **31**. Note that, in the drawing at Step S**2** shown in FIG. **5**, there has been shown the example where the components **34** are mounted on the upper portion and the lower portion of the first circuit board **31**, respectively, but the components **34** may be also mounted on another portion, for example, the right portion or the left portion.

At Step S**3**, mold-sealing is performed. A mold **201** having a predetermined shape is put on the first circuit board **31** on which the components **34** are mounted, and a resin is injected to the mold **201** to perform the mold-sealing.

The mold **201**, as shown in Step S**3** of FIG. **5**, is shaped so as to cover the components **34**, and is shaped so as to surround the outer circumference portion of the first circuit board **31** at a predetermined width.

Further, in the mold **201**, a width on a side in contact with the first circuit board **31** as a width of an inner wall interval is set to the width a+the width b+the width c, and a width on a side opposite to that face and on which the frame **24** is to be put is set to the width d. Note that this width is not necessarily the same in every portion of the mold **201**, and as shown in FIG. **5**, a width of the mold **201** arranged in the horizontal direction in the drawing may be set to be different from a width of the mold **201** arranged in the vertical direction. Further, a predetermined portion may be formed thicker than another portion.

At Step S**4**, the mold part **35** is formed by removing the mold **201**. At subsequent steps, the imaging element **33** is mounted on the center portion of the first circuit board **31**, and the upper part **11** is put on the mold part **35** to manufacture the imaging apparatus shown in FIG. **1** (not shown).

The case where the mold **201** is used to perform the mold-sealing to form the mold part **35** has been described here as an example, but the components **34** may be sealed by another method to form the mold part **35**.

For example, the first circuit board **31** may be covered with the mold part **35** previously formed of a predetermined material and bonded thereto. In this case, for example, a space for storing the components **34** may be previously formed in the inside of the mold part **35**, but the components **34** is preferably covered with the mold part **35** with a least possible gap.

Furthermore, the mold part **35** molded of a soft material may be pressed to the components **34** and attached to the first circuit hoard **31**, and then the mold part **35** may be formed on the first circuit board **31** at such a step that the mold part **35** is cured.

Furthermore, the mold part **35** may use not a single material, but a plurality of materials. For example, a portion in contact with the component **34**, in other words, the inside of the mold part **35** may use a relatively soft material, and the outside of the mold part **35** may use a rigid material.

Furthermore, when the mold **201** is used in forming the mold **35**, the plurality of molds **201** may be used to finally form the mold part **35**. For example, the mold **201**, with which the components **34** are covered, may be used to inject a first material to form the mold part **35**, with which the components **34** are covered, and then a mold **201'** different from the mold **201** used for the first time may be used to inject a second material to form the mold part **35** for the second time.

Note that the manufacturing step described with reference to FIG. **5** is an example, the mold part **35** and others may be manufactured at another step. For example, there may be used such a step that the imaging element **33** is attached to the first circuit board **31** and then the mold part **35** is formed.

<Another Configuration of Lower Part of Imaging Apparatus>

FIG. **6** shows another configuration of the imaging apparatus. In an imaging apparatus **100** of FIG. **10**, since an upper part **11** basically has the same configuration as that of the imaging apparatus **10** of FIG. **1**, it is denoted with the same sign and the description is omitted.

Although a lower part **112** also has the same configuration as that of the lower part **12** of FIG. **1**, since the shape and the like are different, description is added to different portions. A mold part **135** of the imaging apparatus **100** of FIG. **6** is shaped so as to mount an IRCF **24**. As shown in FIG. **6**, steps are provided in the inside of the mold part **135**, and the IRCF **24** can be mounted on the steps.

In order to provide such steps in the mold part **135**, a shape of the mold **201** (FIG. **5**) may be set to such a shape. Alternatively, the mold part **35** without steps as shown in FIG. **1** may be formed, and then a portion where the steps are to be formed may be polished to form the steps.

In any case, the steps are provided in the mold part **135**, and the IRCF **24** is directly mounted on the steps of the mold part **135**, thereby allowing an assembly flow to be simplified.

In the imaging apparatus **10** of FIG. **1**, the frame **25** holds the IRCF **24**. In the imaging apparatus **100** of FIG. **6**, the IRCF **24** is mounted on the mold part **135**, thereby allowing the frame **25** to be omitted.

Accordingly, a step of manufacturing the frame **25**, a step of mounting the IRCF **24** on the frame **25**, a step of mounting the frame **25** on the lower part **112**, and the like can be omitted, thereby allowing the assembly flow to be simplified.

Furthermore, when the frame **25** is eliminated, it is possible to thin the imaging apparatus **100** by the thickness of the frame **25**.

The center portion of a first circuit board **131** of the imaging apparatus **100** of FIG. **6**, on which an imaging element **133** is to be mounted, is formed into a space (cavity), and the imaging element **133** is stored in the space. Further, a second circuit hoard **132** is attached to the back face of the first circuit board **131**. That is, the imaging element **133** is directly mounted on the second circuit board **132**, and the first circuit board **131** is connected to the imaging element **133** by wiring **137**. Such a structure can be called a die pad less structure.

The imaging element **133** is mounted on the second circuit board **132**, thereby allowing the thickness of the lower part **112** to be suppressed more than when the imaging apparatus **133** is mounted on the first circuit board **131**. That is, further thinning of the lower part **112** can be realized. The imaging apparatus **100** itself can be thereby thinned.

In this manner, according to the present technology, it is possible to realize further miniaturization and thinning of the imaging apparatus. Further, it is possible to improve the rigidity of the imaging apparatus. Further, it is possible to simplify the assembly flow.

<Electronic Appliance>

The present technology is not limited to the application to the imaging apparatus, it can be applied to electronic appliances in general using an imaging apparatus for an image capturing unit (photoelectric conversion unit), such as image apparatuses such as a digital still camera and a video camera, portable terminal apparatuses having an imaging function such as a cellular phone, copy machines using an imaging apparatus for an image reading unit. Note that a module-like form mounted on an electronic appliance, that is, a camera module may be an imaging apparatus.

FIG. **7** is a block diagram illustrating a configuration example of an imaging apparatus as an example of an electronic appliance of the present disclosure. As shown in FIG. **7**, an imaging apparatus **300** of the present disclosure includes an optical system including a lens group **301**, an imaging element **302**, a DSP circuit **303** as a camera signal processing unit, a frame memory **304**, a display device **305**, a recording device **306**, an operation system **307**, and a power supply system **308**.

The DSP circuit **303**, the frame memory **304**, the display device **305**, the recording device **306**, the operation system **307**, and the power supply system **308** are connected to each other through a bus line **309**. A CPU **310** controls each unit within the imaging apparatus **300**.

The lens group **301** captures incident light (image light) from a subject to form an image on an imaging surface. The imaging element **302** converts a light amount of the incident light formed into the image on the imaging surface by the lens group **301** into an electric signal in a pixel unit and outputs the signal as a pixel signal. As the imaging element **302**, the solid-state imaging element according to the embodiment described above can be used.

The display device **305** includes a panel-type display device such as a liquid crystal display device and an electro luminescence (EL) display device, and displays a moving image or a still image captured by the imaging element **302**. The recording device **306** records a moving image or a still image captured by the imaging element **302** in a recording medium such as a video tape or a digital versatile disk (DVD).

The operation system **307** generates an operation command for various functions held by the imaging apparatus under an operation by a user. The power supply system **308** optionally supplies various kinds of power supplies to be an operation power supply of the DSP circuit **303**, the frame memory **304**, the display device **305**, the recording device **306** and the operation system **307**, to these supply targets.

The imaging apparatus **300** is applied to a video camera, a digital still camera, and a camera module for a mobile device such as a cellular phone. The imaging apparatus **300** can use the imaging element according to the embodiment described above as the imaging element **302**.

Furthermore, in the specification, the system represents a whole apparatus including a plurality of devices.

Note that the effects described in the specification are merely an example, and are not limited, and another effect may be possible.

The present technology is not limited to the above-described embodiments, but various modifications are possible insofar as they are within the scope of the present technology.

Additionally, the present technology may also be configured as below.

(1)

An imaging apparatus including:

a first circuit board in which an imaging element is mounted on a center portion;

a component that is mounted on an outer circumference portion of the center portion of the first circuit board; and

a member that incorporates the component and is provided in the outer circumference portion.

(2)

The imaging apparatus according to (1),

wherein the member is formed by a mold method.

(3)

The imaging apparatus according to (1) or (2), further including:

a lens barrel that holds a lens,

wherein a frame that supports a portion including the lens barrel is located on the member.

(4)

The imaging apparatus according to (3),

wherein the frame includes an infra red cut filter (IRCF).

(5)

The imaging apparatus according to (1),

wherein one side of the first circuit hoard is connected to a second circuit board, and

wherein a reinforcement member for reinforcing connection between the first circuit board and the second circuit board is provided in a predetermined portion of the second circuit board and the member.

(6)

The imaging apparatus according to (1), further including:

a lens barrel that holds a lens,

wherein a portion including the lens barrel is located on the member.

(7)

The imaging apparatus according to (6),

wherein the member is formed in a shape having a step, and

wherein an infra red cut filter (IRCF) is mounted on a portion of the step.

(8)

The imaging apparatus according to (6),

wherein a portion of the first circuit board on which the imaging element is to be mounted is formed into a cavity, and

wherein a second circuit board is attached to a lower portion of the first circuit board, and the imaging element is mounted on the second circuit hoard.

(9)

The imaging apparatus according to any of (1) to (8),

wherein the member is formed by covering, with a predetermined mold, the first circuit board to which the component is attached, and injecting a resin to the mold.

(10)

A manufacturing apparatus that manufactures an imaging apparatus, the imaging apparatus including

a first circuit board in which an imaging element is mounted on a center portion,

a component that is mounted on an outer circumference portion of the center portion of the first circuit board, and

a member that incorporates the component and is provided in the outer circumference portion.

(11)

The manufacturing apparatus according to (10),

wherein the member is formed by covering, with a predetermined mold, the first circuit board to which the component is attached, and injecting a resin to the mold.

(12)

A manufacturing method for a manufacturing apparatus that manufactures an imaging apparatus, the imaging apparatus including

a first circuit board in which an imaging element is mounted on a center portion, a component that is mounted on an outer circumference portion of the center portion of the first circuit board, and

a member that incorporates the component and is provided in the outer circumference portion,

the manufacturing method including:

a step of forming the member by covering, with a predetermined mold, the first circuit board on which the component is mounted, and injecting a resin to the mold.

(13)

An electronic appliance including:

an imaging apparatus including

a first circuit board in which an imaging element is mounted on a center portion,

a component that is mounted on an outer circumference portion of the center portion of the first circuit board, and

a member that incorporates the component and is provided an the outer circumference portion; and

a signal processing unit that performs signal processing for a pixel signal outputted from the imaging element.

REFERENCE SIGNS LIST

10 imaging apparatus
21 actuator
22 lens barrel
23 lens
24 IRCF
25 frame
31 first circuit board
32 second circuit board
33 imaging element
34 component
35 mold part
131 first circuit board
132 second circuit board
133 imaging element
134 component
135 mold part

The invention claimed is:

1. An imaging apparatus, comprising:

a first circuit board and a second circuit board connected to the first circuit board;

a lens configured to receive incident light;

an imaging element on a surface of the first circuit board, wherein the first circuit board is configured to receive the incident light on the surface via the lens;

a component on an outer circumference portion of the surface of the first circuit board, wherein the component is configured to process a signal received from the imaging element;

an intermediate member that surrounds the outer circumference portion of the surface of the first circuit board; and

a reinforcement member on a portion of the second circuit board and the intermediate member, wherein the reinforcement member is configured to reinforce the connection between the first circuit board and the second circuit board.

2. The imaging apparatus according to claim **1**, further comprising:

an infrared cut filter between the imaging element and the lens; and

a frame coupled to the component via the intermediate member.

3. The imaging apparatus according to claim **2**, further comprising a lens barrel on a side of the frame, wherein the lens is held by the lens barrel.

4. The imaging apparatus according to claim **3**, wherein the frame supports the lens barrel.

5. The imaging apparatus according to claim **1**, wherein the component is injection molded.

6. The imaging apparatus according to claim **2**, wherein

a portion of the component has a step shape, and

the infrared cut filter is on the step shape of the component.

7. The imaging apparatus according to claim **2**, wherein

the frame comprises a first portion which extends in a first direction perpendicular to an optical axis of the lens,

the first portion of the frame holds the infrared cut filter,

the frame comprises a second portion which extends in a second direction opposite to the first direction,

a side of the second portion is in contact with a side of the component via the intermediate member,

the side of the second portion faces the first circuit board, and

the side of the component is opposite to the first circuit board.

8. The imaging apparatus according to claim **5**, wherein a side of the component is in contact with the first circuit board.

9. An imaging system, comprising:

a first circuit board and a second circuit board connected to the first circuit board;

a lens configured to receive incident light;

an imaging element on a surface of the first circuit board and electrically coupled to the first circuit board via a wire, wherein

the imaging element is configured to generate image data, and

the first circuit board is configured to receive the incident light on the surface via the lens;

a component on an outer circumference portion of the surface of the first circuit board, wherein the component is configured to process a signal received from the imaging element;

an intermediate member that surrounds the outer circumference portion of the surface of the first circuit board;

a reinforcement member on a portion of the second circuit board and the intermediate member, wherein the reinforcement member is configured to reinforce the connection between the first circuit board and the second circuit board;

an infrared cut filter between the imaging element and the lens;

a frame coupled to the component via the intermediate member; and

a processor coupled to the imaging element, wherein the processor is configured to process the image data.

10. The imaging system according to claim **9**, wherein

the frame comprises a first portion which extends in a first direction perpendicular to an optical axis of the lens,

the first portion of the frame holds the infrared cut filter,

the frame comprises a second portion which extends in a second direction opposite to the first direction,

a side of the second portion is in contact with a side of the component via the intermediate member,

the side of the second portion faces the first circuit board, and the side of the component is opposite to the first circuit board.

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